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PARTIAL EXPLORATION PLAN
ENVIRONMENTAL BASELINE DATA COLLECTION AND MONITORING ELEMENT
SUPPLEMENT: GEOLOGIC EXPLORATION PROGRAM

TRACT U-a
SUN OIL COMPANY
and
PHILLIPS PETROLEUM COMPANY
TRACT U-b
WHITE RIVER SHALE OIL CORPORATION

U. S. DEPARTMENT OF INTERIOR
OIL SHALE
ENVIRONMENTAL ADVISORY PANEL
Denver Federal Center

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II. A. INTRODUCTION

This supplement to the partial exploratory plan submitted July 1, 1974, by Sun Oil Company and Phillips Petroleum Company for Tract U-a and the White River Shale Oil Corporation for Tract U-b covers the next phase of the exploratory drilling program.

The lessees propose to drill eleven core holes on Tracts U-a and U-b to supplement the initial seven holes drilled as part of the tract nomination program and the three pilot test holes proposed for the ground water hydrology program.

The objective of this proposed program is to supplement the previous exploration activities on the tracts in preparation for submitting the detailed development plan.

The core drilling program provides for an approximate one mile spacing of holes for this phase of the program. Additional core hole locations will be proposed for approval if further geologic and structural information is required for mine design.

A qualified geologist will be on site to observe the drilling contractor's operations, to coordinate geophysical and hydrologic logging, to describe the cores and samples and to properly box and ship core samples to test laboratories. In addition to the analysis for grade by the Modified Fischer Retort method, portions of the recovered core will be tested to determine the structural and physical properties of the rock for engineering purposes as related to mining and for interpretation of geophysical logs. It is hoped that the Mining Supervisor will approve this plan by October 1, 1974, in order that continuity of drilling operations can be maintained with the ground water drilling program.

II. B. EXPLORATION PLAN

The objectives of the proposed program are to:

1. Determine oil shale grade throughout the tracts.
2. Determine whether major fault offsets occur in the oil shale mining zone.
3. Determine the principle partings, joints and fracture systems in the oil shale mining zone and their continuity within the tracts.
4. Determine structural attitude of the strata.
5. Provide core samples for strength of materials testing for initial mine planning and design.

6. Provide additional subsurface hydrologic data.

The proposed core hole program calls for eleven holes. Approximately 2750 feet of core should be recovered. All of the core holes are located on the oil shale tracts. Core hole locations were selected by using topographic maps and a general knowledge of the area. They were field located and staked in mid-July.

Core hole locations were chosen in order to maximize the use of existing roads. Where holes are not located near existing roads, access will either be overland or along dry creek bottoms. It will not be necessary to construct additional roads except where access will be in the dry creek bottoms. In these areas minimum surface disturbance caused during entry will be obliterated by the first substantial runoff (see Section II. C. for more detailed information).

Core holes are located in order to obtain approximately one mile spacing using the seven existing core holes and the three deep ground water holes that will be cored during the ground water program. It was not possible to locate holes in the E1/2 of Section 19 and Section 20, T10S, R24E, because the area is topographically inaccessable at present. Holes will be located in this area in later drilling operations. Table 1, and Figure 1, describe and locate the proposed core holes. Upon approval by the Mining Supervisor, the core holes will be surveyed to establish actual locations and surface elevations.

After completion of each hole, data obtained from logging (see Section II. E. on logging) will be incorporated into an existing regional structure map and depths to coring intervals will be adjusted as needed.

II. C. DRILL SITES

The drill sites were selected to maximize the acquisition of geological and engineering data while minimizing environmental impact. Locations and descriptions are shown in Figure 1 and Table 1, respectively.

Drill sites will not require the removal of any trees or other vegetation, nor will they require the construction of level drill pads. Self-leveling drill rigs will be used to minimize surface disturbance. When drilling is completed, drill sites will be rehabilitated as specified through meetings with the USGS, the BLM, and contractors in accordance with Secretarial Order 2948.

Access to most core holes will be by existing roads in the area. Due to the limited number of roads, however, access to core holes 9 and 10 will be obtained by blading dry creek bottoms with standard road maintenance equipment. This will cause very little surface disturbance as previously mentioned. In addition, access to core holes 2 and 4 will require maintenance of existing roads.

TABLE 1

PROPOSED EXPLORATION CORE HOLES

Core Hole #	Distance From N/S Sect. Line	Distance From E/W Sect. Line	Sect., Township and Range	Estimated Ground Elev.	Estimated Mahogany Marker Elev.	Depth of Mahogany Marker	Cored Interval	Total Depth
1	2150/S	900E	30-10S-24E	5307	4287	1020	890-1140	1180
2	650/N	1550/W	14-10S-24E	5010	4355	655	525- 775	815
3	900/N	1500/W	18-10S-25E	5260	4820	440	310- 560	600
4	225/S	650/W	14-10S-24E	5250	4395	855	725- 975	1015
5	1900/N	500/E	23-10S-24E	5380	4570	810	680- 930	970
6	1000/N	900/W	19-10S-25E	5460	4815	645	515- 765	805
7	550/S	1300/E	19-10S-25E	5620	4980	640	510- 760	800
8	1000/S	2200/W	26-10S-24E	5485	4655	830	700- 950	990
9	2150/N	2250/W	27-10S-24E	5470	4490	980	850-1100	1140
10	200/N	2500/W	33-10S-24E	5495	4485	1010	880-1130	1170
11	900/N	1950/E	28-10S-24E	5265	4380	885	755-1005	1045

Representatives of the USGS and the BLM, accompanied by the operator and the contractor in charge of such construction, will meet on site to agree to any access routes selected; ensuring a minimum disturbance of the land surface. At no time will the operator block access of public vehicular traffic or livestock movement. Any damage to public or private property in the area will be avoided; however, if such damage does occur the operator will make compensation promptly. For more detailed information on proposed access to core holes 9 and 10, see Table 2 and Figure 1.

TABLE 2

ACCESS TO CORE HOLES

NOT LOCATED ON EXISTING ROADS

Core Hole #9 -	Access would be by blading a ten-foot wide road from the main road in Section #28, T10S, R24E, up the dry creek bottom to the center section 27, T10S, R24E.
Core Hole #10 -	Access would be by blading a ten-foot wide road 4/10 of a mile from El Paso Southam Canyon Unit #5 up the dry creek that flows south from the center of section 33, T10S, R24E.

II. D. DRILLING OPERATION

The type of truck-mounted drilling units used will be capable of drilling to a depth of 1500 feet and be equipped with an on-board air compressor. They will be available for use after completion of the ground water program, around October 1, which is the proposed startup date for the exploration core hole program. All drilling units will work ten hours per day and are scheduled to complete a hole in six to seven days depending on the depth. It is anticipated that two or three drill rigs will be utilized. Air mist will be used as a drilling fluid in order to minimize the chance for the formation of a downhole explosive mixture and to provide for the collection of the best possible data.

Should it become necessary to convert to mud as a drilling fluid, portable mud tanks will be used to mix and circulate drilling fluids. Without the necessity of mud pits, minimum surface disturbance can be achieved.

As small quantities of gas may be encountered during drilling, an automatically operated 6" Regan blowout preventer will be installed and tested daily. If gas is encountered, samples will be taken for analysis.

DRILLING PROGNOSIS

1. Drill a 12 1/2 inch surface hole to a depth of 35 feet and cement 30 feet of 7 inch casing in the bottom of the hole.
2. Dig a 6 foot cellar (hole) for installation of blowout preventer.
3. Install 6 inch Regan blowout preventer and rotating head to flange on top of casing. Pressure test blowout preventer to 750 psi.
4. Connect blooey (water discharge line) and pressure relief lines to rotating head and drill rig.
5. Drill cement out of casing with 5-5/8 inch rock bit and continue to drill until 130 feet above the Mahogany Marker.
6. Use a 4-27/32 inch x 3 inch corehead and a 20 foot core barrel to core a 250 foot section to a depth of 120 feet below the Mahogany Marker. The core will be 3 inches in diameter.
7. Drill an additional 40 feet with 4-3/4 inch rock bit.
8. Run geophysical logs as described in Logging Section II. E.
9. Leave core holes open during the life of the project so that pump tests could be conducted on each hole in the manner described in the environmental baseline collection and monitoring program.
10. Equip all holes with removable caps.

II. E. GEOPHYSICAL LOGGING

Geophysical logs will be run in each of the drill holes after completion of drilling. The well logging industry provides numerous different logging systems, but it is felt that only certain types are pertinent to the evaluation of the oil shales within Tracts U-a and U-b. The logs which will be run in the holes will provide more than adequate information to assess the physical properties of the oil shales and to permit stratigraphic correlation. The following geophysical logs will be obtained as required:

1. Compensated formation density log (gamma-gamma density).
2. Natural gamma-ray log.
3. Caliper log.
4. Laterolog resistivity log (i.e. electrode contact-type resistivity log).

5. Spontaneous potential log.
6. Sonic log.
7. Compensated neutron log.
8. Production log (flowmeter and temperature).

Selected core samples from at least one of the drill holes will be tested for matrix density, porosity, water saturation, and gamma radiation to assist in properly evaluating the geophysical logs. The assay results from the Modified Fischer Retort assay and the rock mechanics data will also be correlated with the geophysical logs in order to determine the usefulness of these logging techniques in making reserve estimates and in mine planning. The correlation of logs between holes will provide information on continuity of physical properties which must be considered in mine design.

II. F. CORE EVALUATION

A geologist will direct the drilling operations, prepare field descriptions of the cores, including the location and inclination of fractures and joints, and supervise the boxing and shipping of samples to test laboratories. The core samples will be wrapped and sealed prior to boxing to prevent loss or gain of moisture.

Drill cuttings will be collected at ten-foot intervals except for cored intervals. Oil yield assays will be run on one-foot increments of the core using the Modified Fischer Retort method. Analysis for nahcolite will be run if this mineral is identified in the core. Trace element analyses will be run on ten-foot increment samples of the overburden and raw and spent shale, from both the drill-cuttings and the cores, for arsenic, antimony, boron, cadmium, fluoride, mercury and selenium. Analysis will also be run on ten-foot increment samples of the cored oil shale section for extractable alumina to determine its potential for economic recovery. Portions of the recovered core will be used for physical testing.

The rock mechanics investigation necessary for the evaluation of and physical characteristics of the groundmass immediately above and below the economic oil shale zone, and also within the zone, will provide design criteria for underground mine development.

A suite of test specimens will be taken from the core at ten-foot intervals, commencing fifty feet above the economic zone and continuing to fifty feet below the economic zone. Sufficient amounts of core will be available to allow for the preparation of two test specimens from each interval. One specimen from each interval will be tested to destruction and the other preserved in a manner that will allow further testing at a future date.

The test procedure will include deformation tests, uniaxial compressive testing to destruction, triaxial compressive testing to destruction, the Brazilian test and density determination.

ASTM standard testing procedures and specimen preparation procedures shall be followed for those physical property determinations which are covered by ASTM standards (e.g. uniaxial compressive strength).

The deformation tests will include both uniaxial and triaxial loading of selected specimens to within 80 percent of their apparent compressive strengths for a period of forty-eight hours to determine the time creep and/or rebound parameters. In addition, selected specimens will be subjected to a cyclic loading to within 70 percent of the apparent compressive strength to delineate any tendency toward either work hardening or fatigue. Creep testing will provide information necessary for the design of a minimum failsafe pillar in areas where Poisson's ratio and other physical moduli might vary through a finite vertical section of the shale. The cyclic loading, followed by destructive testing, will further delineate pillar design by including the effects of seismic loading, including blasting and the vibrations generated by large mining equipment operating in a confined space.

The remaining test specimens will be subjected to either uniaxial, triaxial or Brazilian testing to develop the modulus of elasticity, the modulus of rigidity, Poisson's ratio, Shore Schleroscope hardness, shear strength, the angle of internal friction, Mohr envelope and density for each physically distinct zone. This quite of tests, including the recorded physical geologic structure, will allow for the design of an underground mine.

The preserved specimens will be subjected to tests as necessary to verify any questionable data or to further delineate zones where the statistical variation is excessive.

II. G. CORE DISPOSITION

After the core is described and boxed it will be shipped to a laboratory for further processing. At this time, a mining engineer will select the samples on which rock mechanic tests will be performed.

The remaining core will then be split and assayed by the Modified Fischer Retort method. Upon completion of rock mechanics tests, samples previously removed will be assayed to complete the data file. The remaining core will be shipped to a warehouse in either Vernal or Salt Lake City, Utah, where it will be preserved and made available for inspection by appropriate governmental agencies.

II. H. ENVIRONMENTAL CONSIDERATIONS

The following sections of the partial exploration plan submitted to the Mining Supervisor and the Oil Shale Environmental Advisory Panel, July 1, 1974, apply to the drilling program herein:

Section VI.D.	Geology and Soils
Section VI.E.	Historic, Scientific and Aesthetic Resources
Section VI.F.	Initial Fish and Wildlife Management Plan
Section VII.E.	Waste Management Program
Section VII.F.	Safety, Fire Prevention and Other Control Measures
Section VII.G.	Construction Details and Surface Rehabilitation

Drill Hole
Bonanza
(BM 5456)
Ore Storage Ponds
Ore Storage Pond
Well
Reservoir
Gas Well
PIPELINE
TRENCH
JEEP TRAIL
R23E
R24E
Canyon
Wagon Hound
Hound Canyon
Pumping Station
Stage Stop (Site)
BM 5002
Wells
WHITE
RIVER
Creek
P-1
Gas Well
MAN CANYON GAS FIELD
BM 5434
BM 5534
BM 5318
5550
5585
5688
45
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Bonanza
(BM 5456)
Ore Storage Ponds
Ore Storage Pond
Well
Gas Well
Reservoir
TRENCH
PIPELINE
WHITE RIVER
Cowboy
Canyon
JEEP TRAIL
Little Dicks Bottom
Spring
Cripple Horse Canyon
Weaver Canyon
WEAVER
Hells Canyon
Canyon
Gaging Station
Ignatio Stage Stop (site)
Creek
P-1
BM 5290
BM 5301
BM 5318
BM 5634
UINTAH CO.
RIO BLANCO CO.
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MAN CANYON GAS FIELD
WHITE RIVER
WHITE
RIVER
SOUTHMAN CANYON
GAS FIELD
Southam Canyon
Asphalt Wash
Evacuation Creek
Creek
PIPELINE
Gas Well
Drill Hole
JEEP TRAIL
P-1
P-2
P-3
BM 5280
BM 5301
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R23E
R24E
R24E
R25E

LEGEND

- - - - - - - -	PROPOSED ACCESS
—·—·—·—	EXISTING ROADS NOT SHOWN ON MAP
— — — —	BOUNDARY OF OIL SHALE TRACTS U-a & U-b
⚠	EXISTING CORE HOLES WITH AVAILABLE INFORMATION
◎	PILOT TEST HOLES FOR GROUND WATER PROGRAM
×	PROPOSED EX-CORE HOLES

REVISIONS

1 DATE	BY
2 DATE	BY
3 DATE	BY
4 DATE	BY
5 DATE	BY

FIGURE I

vtn colorado Inc.
ENGINEERS ARCHITECTS PLANNERS
6875 EAST EVANS AVENUE DENVER, COLORADO 80222 (303) 759-4271

SUN OIL COMPANY, PHILLIPS PETROLEM COMPANY
AND THE WHITE RIVER SHALE OIL COMPANY

PROPOSED EXPLORATION CORE HOLES

EASTERN UINTA BASIN., UTAH

COMPILED BY KEITH MALONE FOR SUN OIL COMPANY

DES BY:	CKD BY: N.G.	SCALE: 1" = 2000'
DWN BY: L.D.	DATE: 8-14-74	JOB NO. 1517-37

Form 1279—3
(June 1984)

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